

SCALE INFO

When we use "scale" we are enabling us to use a small drawing to diagram a larger project. If we wanted an extremely accurate drawing of an object, we would draw a picture of it at Full Scale. That is, draw it full size. For every foot of object you would have a foot of drawing. You could trace an object and that would be "life Size," or "full scale."
When you draw a ground plan of the stage on a piece of plain paper, you are showing a representation of the stage. In most of our ground plans, we use 1/2" scale. That is, each half inch of a line on our drawing equals a one foot line on the floor. For one of our 4'x8' platforms, we would draw a rectangle at 2 inches by 4 inches. (2"x4"). A 2 inch line contains four 1/2" parts. hence, in 1/2" scale, 2 inches equals 4 feet.
The same goes for any scale that we choose. 1/4" scale means that our 4'x8' platform would be 1 inch by 2 inches on our paper. 1" scale, which is 1" = 1'0" (1" on paper = 1'0" on the stage floor) would give us a 4"x8" rectangle on our paper. This sounds like it would be the easiest scale to use, next to full scale. Well, it is! Until you get to drawings that won't fit on your paper.
My drafting table in the shop is 3'x5'. That would be the largest piece of paper that could fit. Now, we must take into account that the drafting arm doesn't travel to the very edges and our drawing starts to get smaller. The usable space is approx. 2'6"x 4'0". When was the last time you tried to get a piece of paper this size Xeroxed?
The standard scale that we use is 1/2"=1'0". You may find yourself needing to use 1/4" scale when you have a lot of info to give and very limited paper size. Keep in mind that for details, you need to go bigger in your drawings. We tend to use 3"=1'0" scale for some details and when exact detail is required, such as moldings, we will do a separate drawing in full, 1'0"=1'0" scale.

CUT LIST: Gives info to cut lumber for flats and platforms.

LUMBER SIZES

Board lumber comes in many different sizes, types and shapes. Most of the lumber we use in set building is taken from fast growing soft wood trees. We must do our best to recycle as much lumber as we can. While wood does grow on (in) trees, we should do our part in preserving our natural resources.

We use the following sizes of board lumber the most. You'll notice that the list has two different columns on the left. One labeled Name and the other labeled Actual. A 2"x4" is not actually 2 inches by 4 inches when it reaches the lumber yard. You see, when the wood is cut from the log at the saw mill, the actual size is 2 inches by 4 inches "rough cut". Rough cut means the surface of the wood has rough saw marks all over it. When you get the lumber, it has already been smoothed via a large wood surface planer. When you pass wood through a surface planer, the blades take off 1/8th of an inch from each side. The result is a smooth piece of wood that is smaller then it's name.

The Actual dimensions may vary from wood to wood. You should always double check the actual size before finalizing your cut lists. Let's say your cut list calls for 1x3 to be cut to 3'7" for the toggle of a 4x8 flat... If the 1x3 were to be 2 3/8ths instead of 2 1/2", the flat would be just a bit narrow.

Name	Actual	Use
1"x3"	3/4"x2 1/2"	Used for framing flats.
1"x6"	3/4"x5 1/2"	Used for framing door flats where extra rigidity is needed. Also can be used for framing light weight platforms. Platforms using 1"x6" need more legs and extra bracing then platforms using 2"x6"
2"x3"	1 1/2" x 2 1/2"	We often use this for stair railings, furniture parts, diagonal bracing and more.
2"x4"	1 1/2" x 3 1/2"	Platform legs, railings, heavy duty flat construction, medium duty platform framing. These are also used for framing houses, wall studs, heavy duty diagonal bracing...
2"x6"	1 1/2" x 5 1/2"	Platform framing, narrow stair steps (treads), stair risers.
2"x10" 2"x12"	1 1/2" x 9 1/2" & 11 1/4"	These two are most often used for stair risers (sides) and for heavy duty beams under platforms. Let's say we wished to have an open span of 12 feet. You could use a few 2"x12" beams, with proper legs at each end, to hold up your platforms

PLYWOOD

Plywood. If you take a look at plywood, you'll see that it is indeed made up of a number of plies of wood. In other words, several sheets of very thin wood is sandwiched together to make a wooden board. Each ply is set in a 90 degrees direction from the last. The top and bottom plies run the same direction: the long way. So, you'll have the grain running longer then not.

Plywood comes in several different thickness, types and grades. I'm only going to get into the plywood we use most often.

Plywood comes in standard 4'x8' sheets and is always square. The thickness we use most often are: 1/8", 1/4", 1/2" and 3/4"

- 0. 3/4" plywood. used most often for covering platforms. it is very strong and is fairly rigid.
- 0. 1/2" plywood. We use 1/2" for building a lot of props, boxes, furniture parts. It's lighter then 3/4" ply. Cheaper too.
- 0. 1/8" & 1/4" plywood. Great for making hard covered flats. The thickness depends on how rigid you need the flat to be. you must also take into account how much you need your flats to weigh. If you're flying your flats, you may wish to use the 1/8". That is if you're not going to soft cover them.

Grades of plywood.

Plywood comes in several grades. The grade refers to the surface covering. The better the grade, the nicer the surface. The grades are represented via letters, A, B, C, D, X.

- 0. AA is great stuff. It is smooth on both sides with no knot holes. It's used to build nice furniture type objects. Book shelves that are open, thus allowing both sides of the plywood to be seen
- 0. AC is more common. One side is the good stuff and the back is ok. We used AC for flooring that is going to be seen by audience members. That is, seen up close and that is not going to be covered with carpet, etc.

- 0. CDX is ugly stuff. But it's cheap and works. The surface has big unfilled knot holes on the back (D side). Keep in mind that since this is just the surface ply, it doesn't show through as a knot hole in a piece of wood would. This is perfect plywood to use on platform tops when the platform is also getting covered with something like Homosote.
 - 0. I'm starting to use OSB. It's ugly and heavy. But it's cheap and strong. As strong as AC ply and as cheap as CDX. It will dull your saw blades faster because of the resin used to glue the Oriented Strands to form the Board (hence OSB) together.
- Some do's & don'ts.
- 0. Anything that is taller than you are can be hard to handle. This stuff can be heavy.
 - 0. Do ask for help when moving heavy plywood.
 - 0. Always have assistance when cutting full sheets with a power saw.
 - 0. Be careful of splinters! Ply tends to give them easily.
 - 0. Ply is much stronger along the grain.
- Store it either flat or as close to vertical as you can. If you lean it against a wall, at an angle, it'll warp.

Common Sheet Goods Used for Platform Lids in Theatrical Construction

Name

Actual Size

Description

Advantages

Disadvantages

Average Cost as of March 2000 in US \$\$

Plywood, 3/4" AC

4' x 8' x 23/32" thick

5 to 7 layers of wood laminated to the nominal thickness. Layers have grain running 90 degrees to adjacent layers. "A" side is smooth and "finish" quality.

Strong, will support heavy loads if properly framed and supported available everywhere. Smooth surface can be painted and become the show surface.

Cost, March, 2000 price is about \$32 per sheet. Moderately heavy at 75 pounds per sheet. May have voids inside that can allow point loads to penetrate.

\$32.00

Plywood, 3/4" BC

4' x 8' x 23/32" thick

5 layers of wood laminated to the nominal thickness. Layers have grain running 90 degrees to adjacent layers. C side is plugged and rough, D side often has surface voids.

Strong, will support heavy loads if properly framed and supported. Available almost everywhere. Smooth surface can be painted and become the show surface. Price is usually \$3 to \$5 cheaper than AC Plywood. Often very curved, usually has voids. 75 pounds per sheet May have voids inside that can allow point loads to penetrate

\$28.00

Plywood, 3/4 CDX

4' x 8' x 23/32" thick

6 layers of wood laminated to the nominal thickness. Layers have grain running 90 degrees to adjacent

layers. "B" side is smooth.
About 30% cheaper than AC Plywood

Rarely flat, large voids on D side. Must have some other surface for show side such as Homosote plus masonite or luan.

\$22.50

OSB, 3/4"

4' x 8' x 23/32" thick

OSB means Oriented Strand Board. Wood is shredded and glued up in a resin with the fibers roughly aligned in the direction of the board.

No voids, generally flat, structurally equal to or stronger than 3/4 AC plywood, but about the cost of CDX.

About 10% to 15% heavier than equal thickness of plywood, about 85 lbs. Per sheet. Must have a show surface of masonite or luan etc. resin dulls tools rapidly.

\$22.50

Particle Board, 3/4"

4' x 8' x 23/32" thick, some brands 3/4" true.

Particle board is made of wood that is ground up roughly and glued up in a resin.

No voids, generally flat, but usually less than the cost of CDX.

20% heavier than equivalent thickness of plywood. Structurally weaker than 3/4 AC plywood. Very hard, screws must be pre-drilled for counter sinks to drive flush, edges and corners break off easily.

\$19.75

PLATFORMS

All platforms consist of three things: the **Lid**, the **Frame** and the **Legs and bracing**.

The purpose of the lid is to support the point load of the actor or scenery, distribute it over as large an area as possible and transfer the load to the frame. The single most common lid material is 3/4" thick plywood. While I have seen 5/8" thick and occasionally 1/2" thick plywood used for platform lids the amount of visible sag was unacceptable and safety was severely compromised. For normal theatrical use, non-dancing, the lid must withstand a bare minimum of 50 psf (pounds per square foot). For any kind of action, several actors close together, 100 psf is needed and for dancing 150 psf is an absolute minimum, 250 psf is better. For tap, clog, Riverdance etc. try to imagine the force of three or four dancers coming down at once. Dancers can generate a ten-fold force during a landing, stomp or tap maneuver. For example, three 110 pound ladies clogging in unison can create 110 lbs. x 3 dancers equals 330 lbs., 330 lbs. times ten equals 3,300 pounds of instant impact on a single platform. The exact load rating of any platform is a combination of all three components and is beyond the scope of today's article. However, for the purpose of this discussion, an average platform will safely support about 100 psf in a static load situation. That means a standard 4' x 8' platform will support about 3,200 pounds evenly spread out over the entire surface. Of course that figure assumes that the legs and bracing and the stage floor below the platform are also capable of and designed to support that load.

The purpose of the frame is to support the lid and transfer the load to the legs and bracing. The type of frame material and its strength will determine the spacing between legs and braces. The frame should support the weight without bending more than 1/360 of the span between supports or a 1" sag in a 30' span. This is about 1/4" in an eight foot span or 1/8" in a four foot span. So, if you build a platform and it sags 1/2" when your actor stands in the middle, you need to cast smaller actors.....oops.....what I meant to say

was, you need to use larger framing boards or put the legs closer together.

The purpose of the legs and bracing is to transfer the weight from the frame to the floor under the platform and to hold the platform at the desired height and with little or no lateral movement. The methods of legging platforms are so varied that they can and will fill an entire article by themselves.

In the United States, the single most common size of platform is the four foot wide by eight foot long unit and the most common framing material is the plain old ordinary, SPF 2x4. Why are these the standard? It is simple economics and convenience.

Sheet goods are normally manufactured in the 4' x 8' size. While other sizes are available, they are more expensive per square foot and usually must be specially ordered. A 4' x 8' platform needs no sawing or cutting of the deck or lid material, it comes in that size to begin with. Strangely enough, even in countries using the metric system, sheet goods still are made to what they call "Imperial Measurement" and are 4' x 8'. The measurement is metricized to 1220mm x 2440mm but it still equals four feet by eight feet. It might be interesting in a future article to investigate why sheet goods in those countries stayed at 4'x8'. Was it human scale, economics, convenience?

Now what kind of "sheet goods" are we talking about? Generally speaking we are talking about plywood but there are a number of products available with different advantages, disadvantages and cost factors. The following is a brief listing of some materials suitable for platform lids with some of their pros and cons.

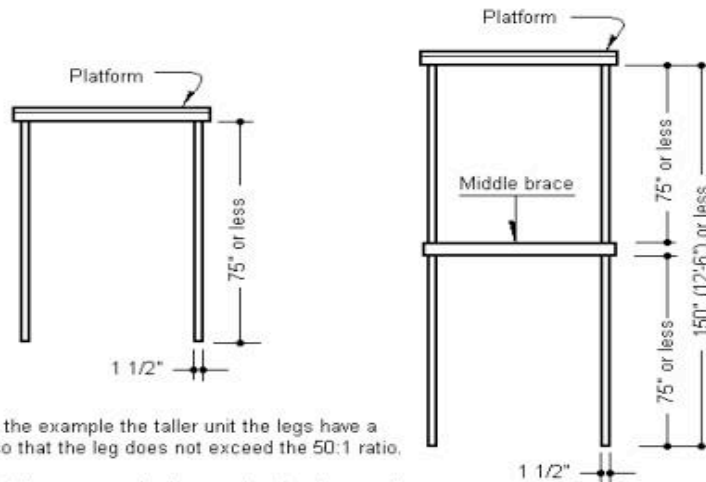
Hello again, and welcome to the Techie's Corner. In the last three articles we have looked at a number of different types of platforms. Not every type, just some of the most used and the most well known. Now we are going to look at how to elevate or leg these platforms to the height needed for our show.

There are more ways of legging a platform than there are of building the platform itself. What makes a legging system right for you depends on your particular situation. Do you have storage space for "stock" leg pieces? Do you have skilled carpenters or do you rely on a group whose skills vary from pro to rank beginner? Do you build your units on stage or in a shop off site? Look at the costs, time, skills, available tools, etc. and decide which system is best for you and your theatre.

Before we describe specific legging systems we need to define just what a legging system does and how it does it. What is legging? Legging is: A system of raising a platform to a desired height, spaced to prevent sagging and with sufficient cross bracing to prevent lateral movement. The function of any legging system is to transfer the load on the platform to the structure it rests on, whether that is the permanent stage floor or other temporary stage platforming. To tell you just how legs and bracing perform that task will require some drawings, a brief explanation of the geometry of a triangles and the ability to multiply by 50.

First let's look at the leg itself and that number 50 that I mentioned. Any leg will be very stiff in short lengths, but every leg will become flexible when it gets long enough. A piece of $\frac{3}{4}$ " x $\frac{3}{4}$ " pine will support 1,000 pounds when it is only one inch long. A 12" steel I-beam will barely support it's own weight at 100' tall, a stiff wind will bend and collapse it. How tall or long can a leg be and be safe? A standard formula that works for theatrical use is a **50:1 ratio**. That is 50 times the narrowest cross section of the leg is the maximum height that leg can be without some form of bracing **to prevent buckling or bending**. This formula will work for all materials used in general stagecraft, wood, steel tube, pipe etc. For example a simple 2" x 4" leg can be 45" tall before it needs bracing **to prevent buckling or bending**. The calculation is simple, the nominal 2" thickness which equals 1 $\frac{1}{2}$ " times 50 equals 75" or 6'-3". If you nail two 1x4 boards together to form an "L" or "T" section, the narrowest dimension is 3 $\frac{1}{2}$ ". Fifty times

3 $\frac{1}{2}$ " equals 175" or 14'-7".

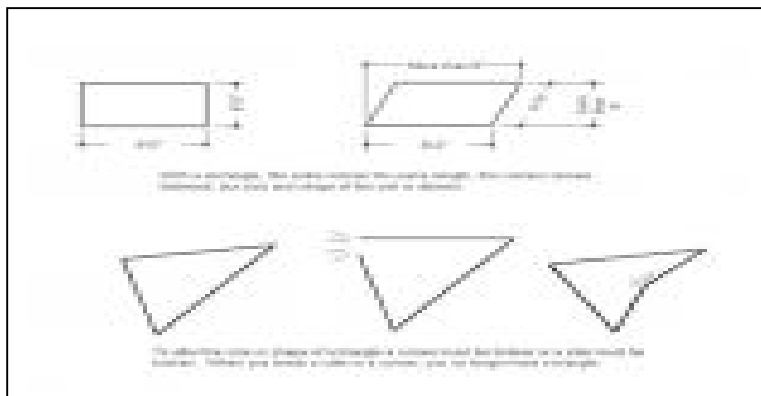


Note in the example the taller unit the legs have a brace so that the leg does not exceed the 50:1 ratio.

Note that these examples have no bracing to prevent sway or sideways motion.

Now, this **DOES NOT** mean you can build a 6' tall platform with 2x4 legs or a 14' tall platform with "L" legs and no cross bracing. The leg is actually fastened to the platform in a very small area and the length provides a very effective lever when the platform sways the least bit. Twenty pounds of sideways push will cause the 6' platform to fold sideways and the legs to split or tear out the fasteners. It would only take about 5 pounds of sideways push to topple the 14' unit.

Now it seems like I have contradicted myself. I said that you could build a platform with a leg 50 times taller than it is thick and then I tell you that it will collapse. The 50:1 leg will support the platform and the load, but only if the weight is completely still and there is no sideways motion caused by walking actors, dancers etc. Our next task is to brace the platform to stop any swaying or sideways motion and this is where the triangle comes into play. The triangle is the only geometric form that can not change its shape without breaking either a side or separating a joint.



Triangular bracing is what makes tall buildings, bridges, the Eiffel tower and other construction possible. Look at a bridge or a building under construction before the bricks

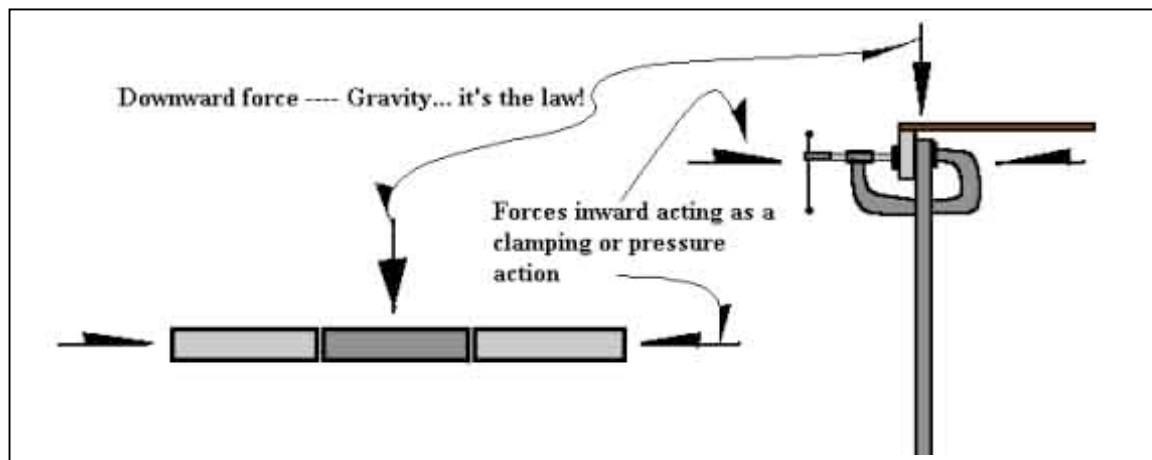
Legs, Legs, Legs! (Betty Grable, Eat Your Heart Out!)

Once again, welcome to the Techie's Corner. In the last few articles we have talked about platforms, the types of platforms, special platforms and how to brace them. This month we will look at legs, legs of many types and how to make them and what their pro's and con's are.

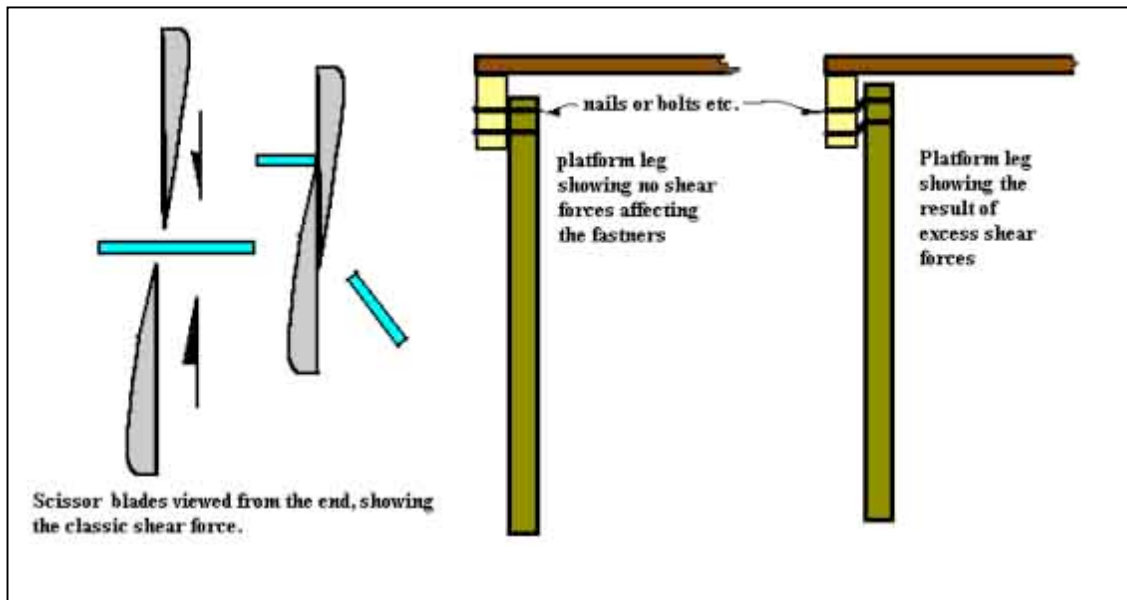
Legs fall into two major types, those that support by friction pressure and/or the shear strength of fasteners, called the standard leg, and those that support by direct, in-line compression, called compression legs. I am sure that there will be several types of legs that I will miss or forget. Please contact me directly and I will make space for those and include them in next month's article.

The basic difference between the two types of legs is manner in which they support their loads. A friction/shear leg relies on the tightness of the fasteners, the sideways friction generated between the leg and the platform and the “shear” strength of the chosen fastener. The compression leg relies on the direct in line compression of the leg material.

The standard leg uses friction as a major element of support. If you have ever seen a magician or “box-juggler” perform a juggling act with three or more cigar boxes (or similar size/shape cardboard boxes) tossing them into the air and catching them between other boxes, you have seen the friction part of the puzzle. If you have ever used a “C” clamp to fasten a temporary leg to a platform or to support a piece of work in the shop you have used this principle. The method of fastening the leg to the platform can add to the friction element. Bolts with nuts add the greatest amount of friction force, screws or lag screws a moderate amount and nails or pneumatic staples, the least.

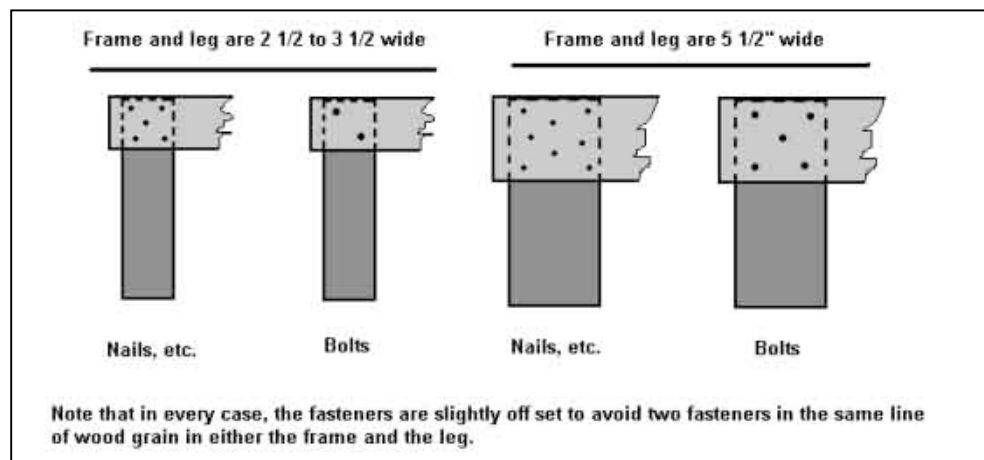


The other half of the equation in the standard leg is the shear strength of the various fasteners. When the leg is fastened to the platform frame, there is a shearing action formed, much like the shearing action performed by common sewing scissors



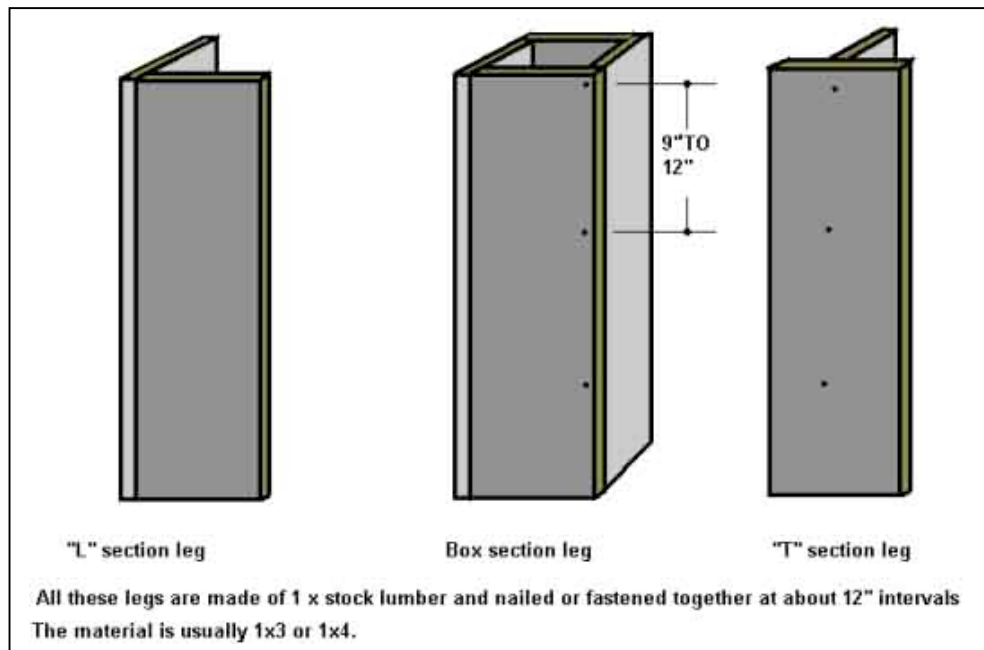
The shear strength of the fastener added to the friction force is the total strength of the “standard” type of leg. It should be obvious by now that fasteners which produce a compressive force will be stronger than those that do not. All fasteners produce some degree of compressive force, smooth shank nails the least, bolts and nuts the most, with screws, staples and ring shank nails falling in the middle.

What may not be obvious is that more fasteners do not necessarily mean a stronger joint. If wood is the construction material and a leg is between 2 ½ “ and 3 ½ “ wide and a platform frame is between 3 ½ “ and 5 ½ “ wide, there are a limited number of fasteners that can be inserted in any joint. At some point the grain of the wood will split or there are so many holes made for bolts that there is no wood left. What is the “right” number of fasteners, is there a specific pattern that is stronger? With nails, screws or staples, the maximum number is 8 if both leg and frame are nominal 6” wide. With bolts, the maximum is 5. If either member is less than 6” nominal wide the maximum number drops.

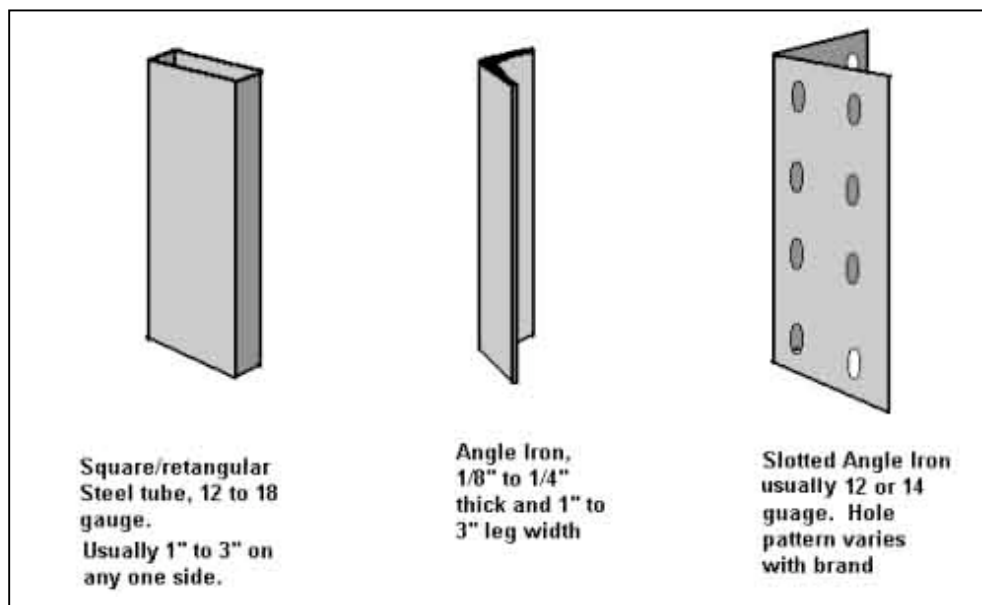


Any additional fasteners than shown above will either add so little extra strength as to be useless or they will actually start to weaken the joint.

The most common standard leg is the ordinary 2x4. It is cheap, strong and easy. Other standard legs are single piece legs made of 2x6, or 4x4. Manufactured legs, those made of more than a single piece of lumber, are almost always made in an "L" section. Other variations are the box tube and the "T" section. "L" section legs are the most structurally sound in terms of weight versus strength. The box leg is used where the bulk look is desired but weight is a factor. The "T" section leg is used when light weight is needed and for design reasons the "T" shape is either visible and more desirable or the bracing is easier to attach.

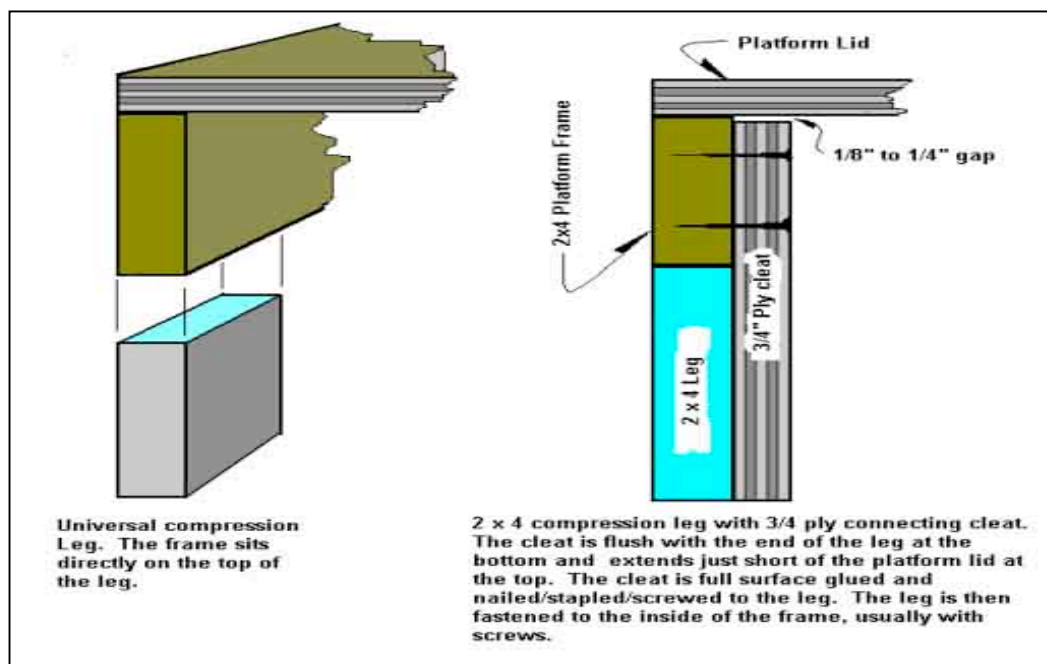


While wood is not the only material used for standard legs, it is the most common. Steel is also used as a standard leg. Square or rectangular steel tube is the most common form of steel leg. Other forms are angle iron, slotted angle iron, Tele-spar, Uni-strut and pipe.

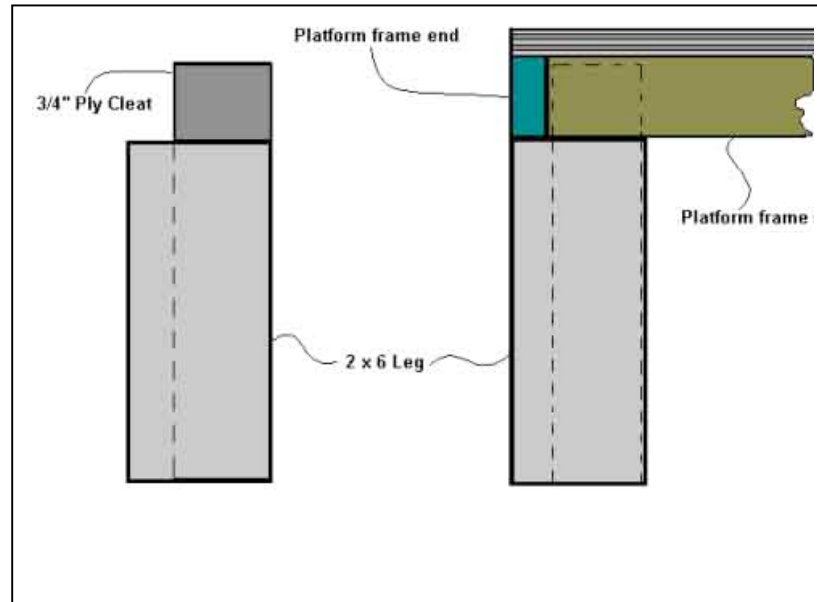


These are all fastened to the inside of the platform frame just as other "standard" legs. While through bolts are the most common form of fastening steel legs to platforms, screws and nails through predrilled holes are another method. One last method of fastening steel legs to platforms is by pneumatic "T" nails. These are specially hardened nails that can penetrate 16-gauge steel tube. Personally I only recommend through bolts to attach steel legs.

The second type of leg is the compression leg. It is called that because the actual support of the leg is in direct compression under the frame. If 100% of the force was straight down and there was absolutely no sideways force, a compression leg would support the load with out any fasteners or bracing actually connecting it to the platform. Of course we all know that the entropy of the entire universe would have to come to a halt for that degree of stillness to exist for more than a very brief moment. Once the leg is braced and secured to other legs, gravity can become the only actual attachment between the legs and the platform. The parallel platform is an example of this as are several commercially built platform systems.

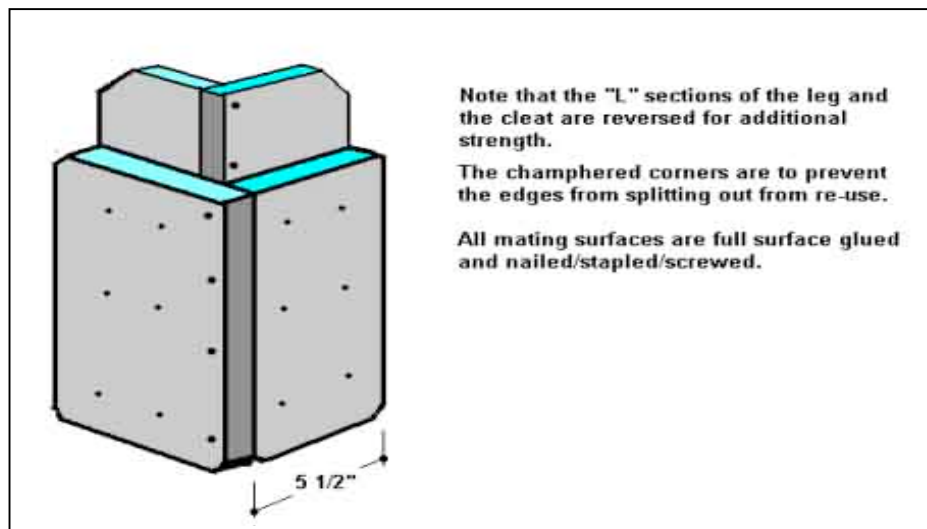


The most common compression leg is the one shown above, a 2 x 4 leg with a $\frac{3}{4}$ " ply cleat attached. For strength in attachment to the platform, the cleat needs to be only 10 $\frac{1}{2}$ " long, or about 3 times the width of the platform frame and the same width as the leg. However the best practice is to continue the cleat flush to the bottom of the leg. This allows bracing and stiffeners on the inside of the legs to all follow the same plane. In addition the full-length cleat adds a great deal of stiffness to the leg, especially over 30" long. One variation of this leg is to use 2 x 6 as the leg but to keep the cleat only 3 $\frac{1}{2}$ " wide and flush to one side. This allows the leg to be placed at the corner of the platform and have the leg actually support both frame pieces at that corner.



Compression legs can also be used with platforms whose frames are one by stock or 5/4 stock, the leg material is simply the same thickness as the frame.

A very good variation on the compression leg is a combination of the "L" section leg and the common compression leg. The leg is made with "by six" stock for the leg, thickness to match the platform frames. The cleat section is also "L" shaped. These legs provide a very stiff, strong leg that needs little or no cross bracing at 3' tall or less.



All of the metal leg types can also be made in to compression legs. To make compression legs of metal requires welding corner brackets to hold the legs and support the platform frames. There many different methods of making the legs, some with a “universal” bracket that can be fitted with different lengths of legs to suit the show and others that have a permanent length of leg welded to each bracket. The brackets are all similar in that they have a flange that supports the frame and a face with predrilled holes for bolts or screws. The main difference between different types is whether the socket for the leg (or the leg itself) is welded on under the bracket or inside the predrilled faces.

The socket type of bracket can also be welded under the corner of the flange but then, if the bracket is left on the platform, it is permanently legged to the height dictated by the length of the socket.

The standard and compression legs cover a large number of the legging situations you will encounter, but by no means will they suit every situation.

The main advantages of the standard leg are:

It is the least expensive legging system for material costs on a one-time basis when using a simple leg such as a 2x4.

They are the quickest method unless you already have a large supply of legs of the desired height in stock, especially if you are using a simple leg such as a 2x4. This can also translate into additional \$\$ savings if your carpenters are paid by the hour.

Leg length is determined by the thickness of the platform lid, which tends to be very consistent compared to the width of framing members.

Requires the least amount of skill on the part of the carpenters.

The disadvantages are:

They tend to shorten the life of stock platforms by “chewing up” the corners with numerous bolt/screw holes.

They are not as strong as compression legs and are rarely suitable for heavy and/or prolonged dancing especially of the clog, tap or step styles.

The main advantages of the compression legs are:

They are far stronger and stiffer when properly braced.

They do not tear up the corners of stock platforms.

If they are built well, they can be used over and over again, more times than standard legs, which can result in a materials saving over time.

The disadvantages are:

They require greater skill and more time to construct.

The length of the leg is dependent on the width of the platform frame members which can vary from one lumber lot to the next even when purchased from the same lumber company. Not every stock platform is the same.

They require more storage space than standard legs.

As can be readily seen, there are many way of legging platforms and I have just touched on some of the major ways to do it. What is right for you depends on the skills of your workers and the tools you have available. It also depends on your budget both in terms of time and money. It can also depend on your available storage area, if you can't store it, do you need to build it to last 20 years?

Next Month we will look at a method of supporting platforms that is very strong and stable but isn't really "legs". It is also very good for supporting raked or sloped stage sections. It is the "Stud Wall" method.

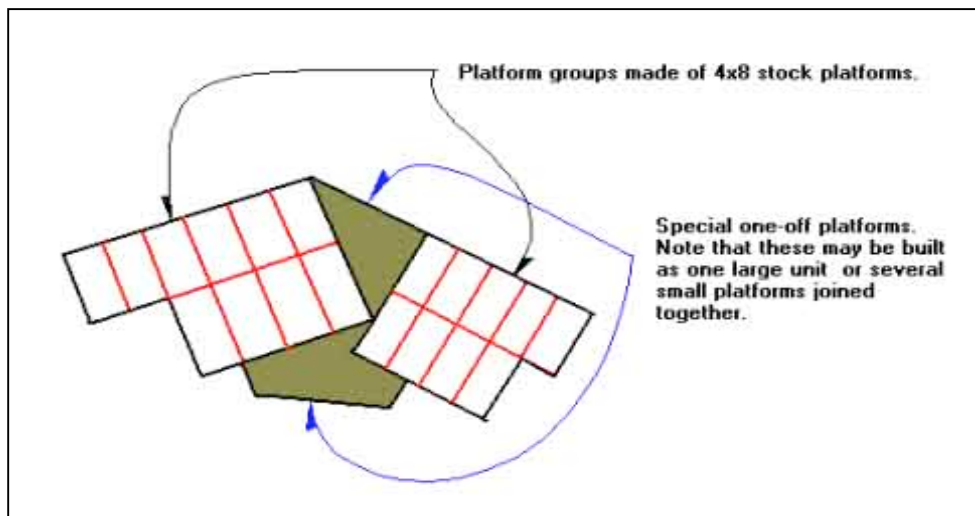
MULTI PLATFORMS

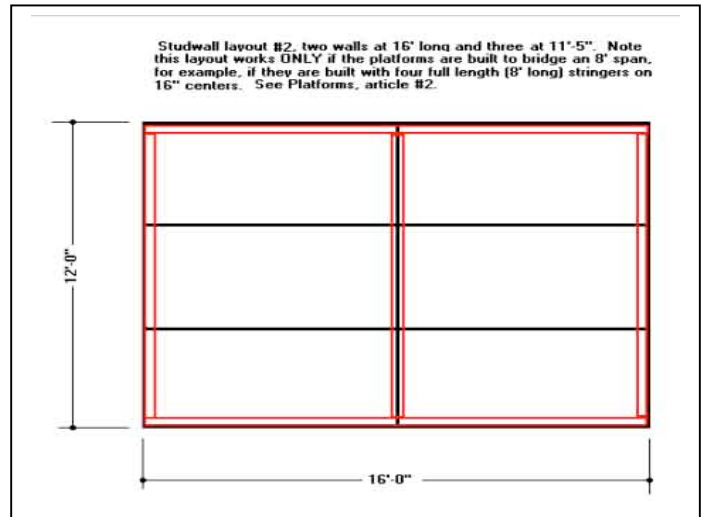
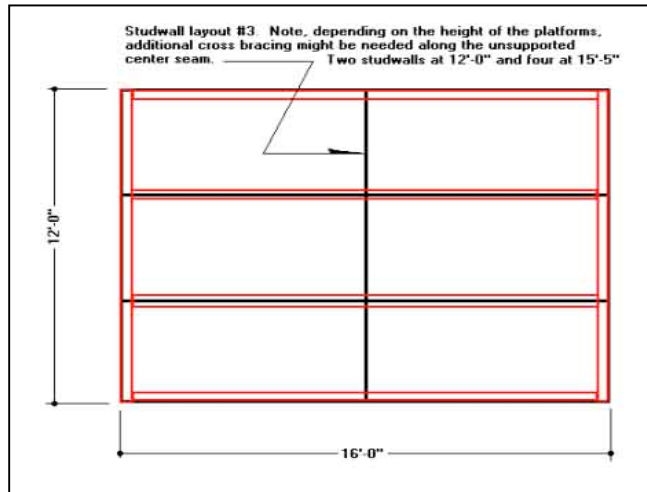
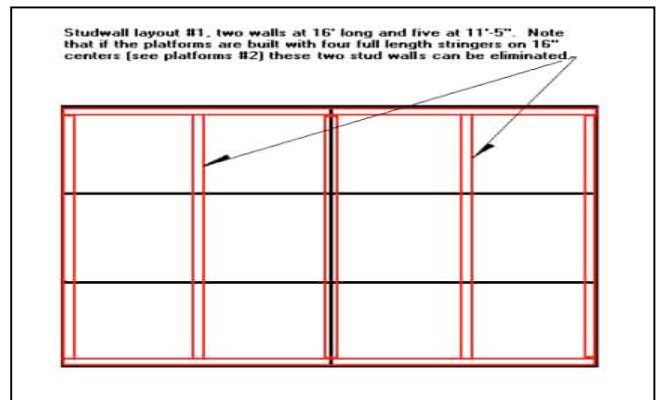
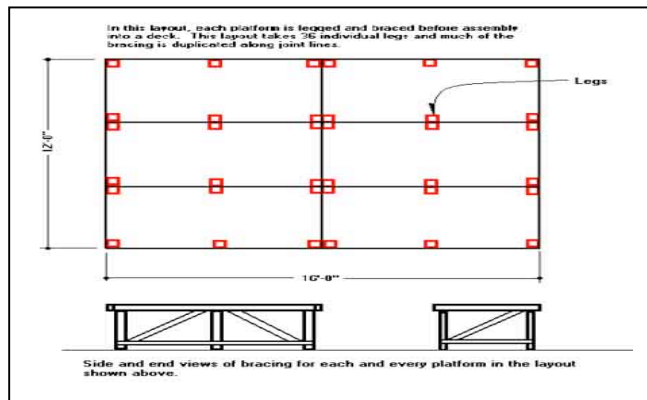
Up to now we have been dealing with single platforms. This month we will look at ways to use studwall supports for decks, large platform layouts and that thing in the middle, the one-off platform.

For those readers who are fairly new to platform layouts in theatre, a one-off platform is one that might be neither 4' nor 8' and may be three sided, four sided, five sided or more, have no angles of 90 degrees and is built specifically for that one show, that one time use. For example, a one-off platform might join two rectangular platform groups to form large, angular formations.

It may seem that I am making such a strong point for studwalls that they are the best way to leg platforms. While studwalls are indeed one of my favorite methods, they are far from the only one I use. There are conditions where studwalls are a poor choice. For example, In the layout shown in the next illustration, bolt on legs or parallel frames would be the most efficient for heights 2' or less. In general, if your overall platform height is 2' or less, stud walls are less likely to be time, material or cost efficient. Even at this low height, studwalls are still the best in overall weight bearing and weight transfer capability of all wood, shop built platform support systems. Each and every situation has it's own solution for "best". Best is the solution that fits your budget in terms of both materials and labor, fits your crew in terms of skills and time to build and works with your theatre in terms of storage, use and reuse.

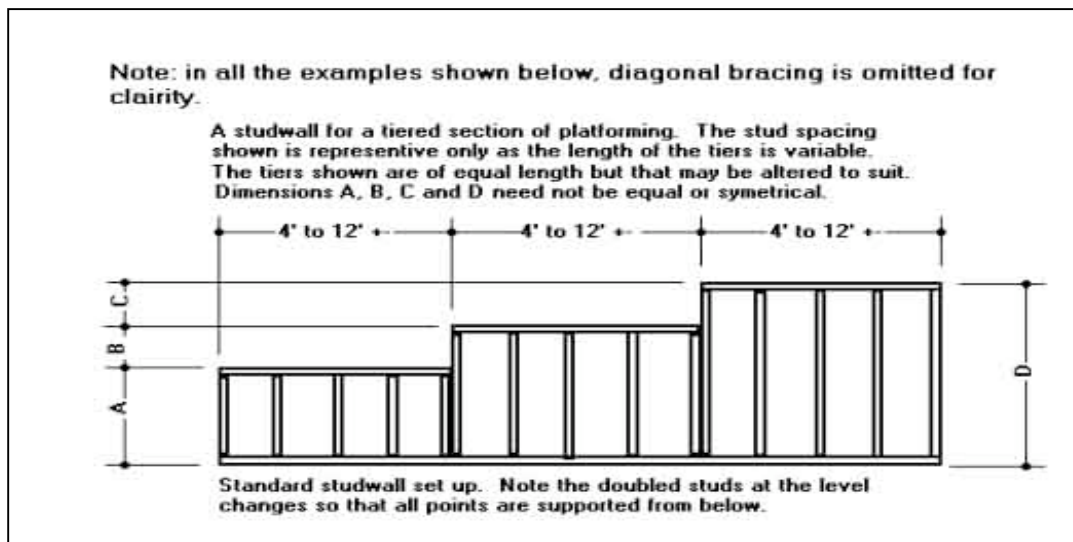
One of the advantages of the stud wall system is the way it works in areas that are larger than single platforms. The following illustrations show you a 16' x 12' deck made up of 4x8 platforms. The first illustration shows the number and layout of legs for that deck. The rest show possible studwall layouts for the same deck.



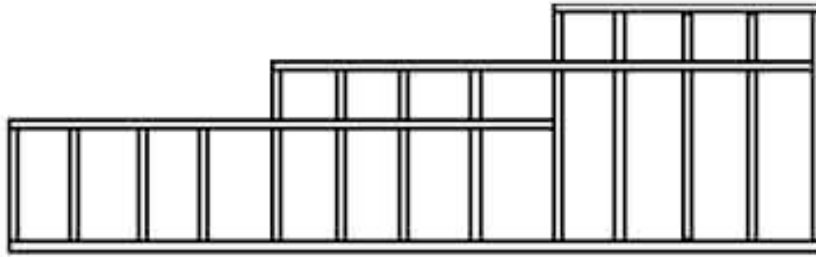


It is easy to see that a small number of stud walls can replace a large number of legs. At first glance, it appears that the stud wall method requires more lumber and more individual boards and thus more time to build. However, studwall legging greatly reduces the amount of diagonal bracing needed. This translates into more "legs/studs" but less cross bracing and tends to equalize the lumber needed. The simplicity of the construction requires fewer construction steps and results in a very fast construction method. If the deck is to be moved stored or toured, it comes apart in very few pieces and packs flat in a truck or storage area.

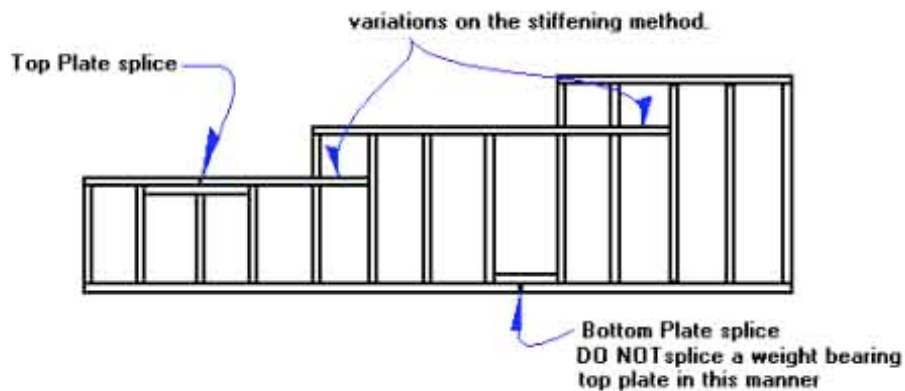
Variations on the studwall can be seen in tiered levels and rakes or ramps. In these platform setups, stud walls can be shaped to fit the stair step shape.



A variation on the standard stud wall form that greatly increases the lateral strength of the wall. This is very useful for dance or large cast shows with group movement from side to side. It is also more resistant to handling and trucking on tour.

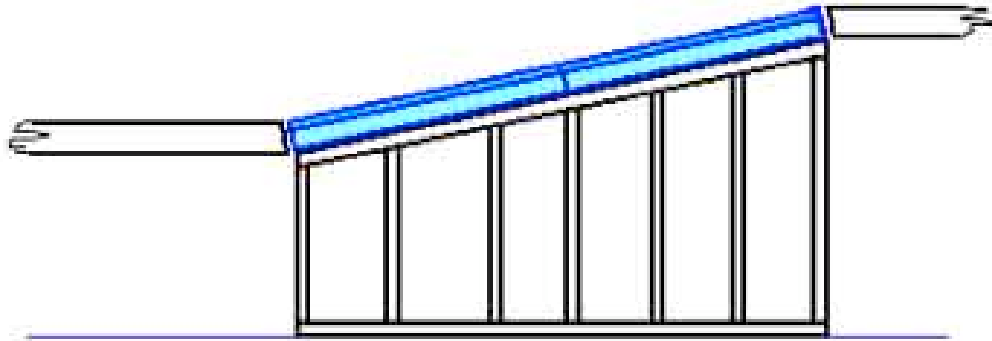


Note: if the plate at the top or bottom must be jointed, you will need to splice the plate in the manner shown. The splice cleat is nailed in from the ends as well as through the plate. If there is a splice in the top plate, it should span two openings and the joint should be supported by a stud. If the studwall is built in place and never moved, the cleats may be omitted.

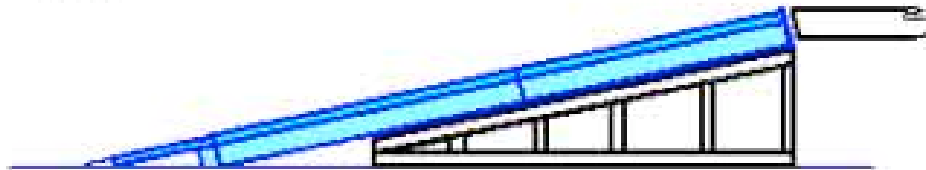


Ramp or rakes are the other half of odd shaped studwalls. Earlier I mentioned that it is rarely efficient in labor or materials to build studwalls for platforms less than two feet high. The exception is when a ramp slopes down to the floor. The ease of making a smooth, even slope is well justified. When you lay out the top and bottom plate on the shop floor, the angle and length of the studs can be marked off directly without measuring, math or trig. If you cut a stud a bit too long or too short, simply move it a fraction of an inch one way or the other until it fits between the top and bottom plate. Elegant? No! Effective, quick, strong and workable? You bet! Two Simple examples of sloped studwall support are shown below.

A raked section of platforming supported by a sloped studwall



**A ramp down to stage level supported by a stud wall.
Note the "half platform" and the piece of 1/4" ply or sheet
metal needed to complete the smooth transition to the stage
floor.**



So far, we have looked a number of ways to use studwalls to support platforms. Next month we will examine some ways that stud walls can be used for more than just to support a deck, such as to bridge openings, support over hangs and other uses. We will also look into how to fasten platforms and decks to the stud walls.